

Continued Optimization of Low-Density Foam-Reinforced Ablatives for High-Velocity, High Heat Flux Earth Return Missions, Phase I

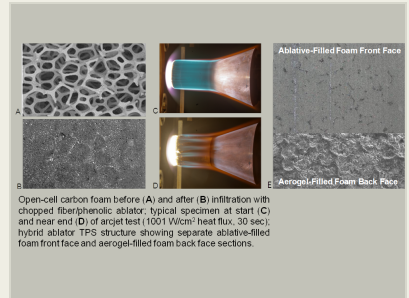
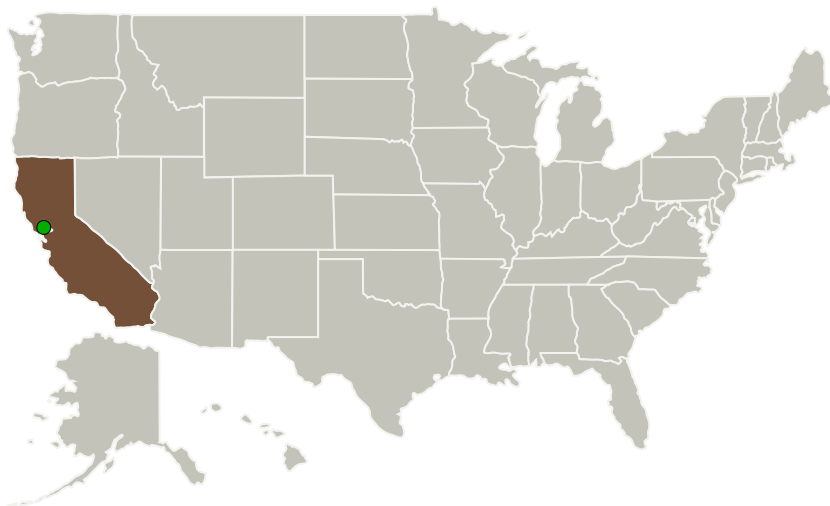
Completed Technology Project (2013 - 2013)



Project Introduction

In previous work for NASA, Ultramet and ARA Ablatives Laboratory developed and demonstrated advanced foam-reinforced carbon/phenolic ablators that offer substantially increased performance under high heat flux conditions and reduced weight relative to conventional ablators. The two-piece structure consisted of an ablative-filled foam front surface backed by Ultramet's previously established and highly insulating aerogel-filled foam. Arcjet testing was performed at NASA Ames Research Center to heat flux levels exceeding 1000 W/cm², with the results showing a significantly reduced ablation rate compared to conventional chopped fiber ablators, and ablation behavior comparable to FM5055 at just one-third the density. It is apparent that the foam helps retain the char layer by physical reinforcement and/or that the network of interconnected passages allows pyrolysis gases to escape with less disruption of the char layer. In this project, Ultramet will team with ARA Ablatives for ablative infiltration of Ultramet foams and Materials Research and Design for ablation analysis, to continue optimization of foam-reinforced ablators by focusing on two primary areas. The ablator formulation infiltrated into the foam will be modified to maximize heat flux capability consistent with NASA Earth return requirements (1500-2500 W/cm²), and a single-piece foam TPS structure will be developed rather than separate ablative- and aerogel-filled foam sections. Preliminary mechanical and thermal testing will be performed to support design and analysis and, depending on availability, initial ablation tests may be conducted at the Sandia Solar Tower Facility. High heat flux testing at the Air Force LHMEF facility or alternative would be performed in Phase II.

Primary U.S. Work Locations and Key Partners



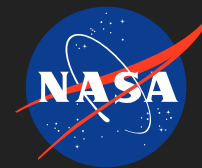
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Organizations Performing Work	Role	Type	Location
Ultramet	Lead Organization	Industry	Pacoima, California
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations

California

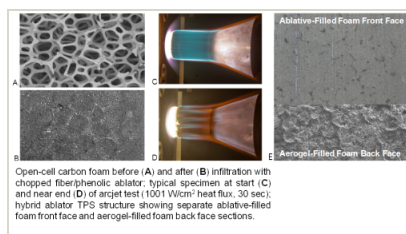
Project Transitions

**May 2013:** Project Start**November 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140707>)

Images



Project Image

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(<https://techport.nasa.gov/image/131426>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ultramet

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

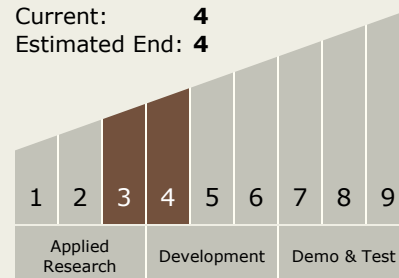
Brian E Williams

Technology Maturity (TRL)

Start: 3

Current: 4

Estimated End: 4



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Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
 - └ TX09.1 Aeroassist and Atmospheric Entry
 - └ TX09.1.1 Thermal Protection Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System